

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**IRRIGATION WATER CONVEYANCE**

**CORRUGATED METAL PIPELINE**

(Feet)

CODE 430II CA INTERIM

**DEFINITION**

A pipeline and appurtenances installed in an irrigated system.

**Scope**

This standard applies to circular corrugated metal pipe 48 inches in diameter or less and arched pipe with span and rise dimensions of 58 inches by 38 inches or less.

**PURPOSES**

To prevent erosion or loss of water quality or damage to land and to reduce water conveyance losses to make possible the proper management of irrigation water.

**CONDITIONS WHERE PRACTICE APPLIES**

All pipelines shall be planned and located to serve as integral parts of an irrigation water distribution or conveyance system designed to facilitate the conservation and management of soil and water resources on a farm or group of farms.

All areas served by the pipeline shall be suitable for use as irrigated land.

Water quality and quantity shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application methods to be used.

**CRITERIA**

**Friction losses**

Friction head losses shall be no less than those computed by Manning Formula, with a coefficient of roughness 'n' as shown in Table 1 for circular pipe. Use Table 2 to determine 'n' value for arched pipe. Table 1 and 2 are contained in 430 I - Material Specification.

**Capacity**

The design capacity of the pipeline shall be based on whichever of the following criteria is greater:

1. The capacity shall be sufficient to deliver the volume of water required to make irrigation practical for use on the crops to be irrigated.
2. The capacity shall be sufficient to provide an adequate irrigation stream for the methods of irrigation to be used.

**Working pressure**

All pipelines shall be designed for partial pipe flow except that reaches of pipe under pressure flow such as swag pipes shall have a maximum design working pressure as follows:

1. Twenty feet of head for annular and helical pipe with sealed seams and watertight couplings.
2. Thirty feet of head for helical pipe with welded seam, annular ends, and watertight couplings.

Head is to be measured from the flow line of pipe.

Pipe with the seams not sealed may be used under partial flow conditions. Watertight couplings shall be used for this condition.

**External load limit**

Fill heights shall not exceed the maximum depths given in Tables 3, 4, and 5 for the gauge, size, and shape of pipe given.

**Vents**

Vents or air and vacuum-release valves shall be designed into the pipeline where needed.

### Drainage and flushing

Provisions shall be made for completely draining the pipeline if a hazard is imposed by freezing temperatures or if drainage is specified for the job.

If required drainage outlets shall be located at all low places in the line. These outlets may drain into dry wells or to points of lower elevation. Drainage and flushing points shall be located to minimize erosion potential and to minimize ponding of water at undesirable locations. If drainage cannot be provided by gravity, provisions shall be made to empty the line by pumping.

### Outlets

Appurtenances for delivering water from a pipe system to the land, to a ditch, or to a surface pipe system shall be known as outlets. Outlets shall have the capacity to deliver the required flow.

1. To a point at least 6 inches above the highest field elevation.
2. To the hydraulic gradeline of a pipe or ditch.

### Pipeline Placement

Pipelines may be buried, placed on the ground, or above the ground. Buried pipelines, which are subject to hazards such as traffic crossings, farm operations, freezing temperatures, or soil cracking, shall be placed deep enough to protect the pipeline. In hazardous situations the minimum cover shall be 1 foot, but in soils susceptible deep cracking the minimum cover shall be 2 feet.

Onground pipelines shall be protected from hazards imposed by traffic crossings, farm operations, or other hazards.

Above ground pipelines shall be adequately supported by vertical bents to prevent the pipe from moving to maintain proper grade and alignment. Spacing of vertical bents shall assure that neither the maximum beam stresses in the pipe span nor the maximum stress at the bent exceed design stress values.

### Thrust control

Above ground pipelines shall the movement of each pipe length restrained by steel holdown straps at the pipe supports or by anchor blocks instead of normal pipe supports.

### Joints and connections

All Connections shall be designed to withstand the maximum pressure of the pipeline without leakage and to leave the inside of the pipeline free of any obstruction.

Bolts used to join galvanized steel must be galvanized, plastic coated, or otherwise protected to prevent galvanic corrosion. Bolts used to join aluminum, other than aluminum alloy bolts, must be galvanized, plastic coated, or otherwise protected to prevent galvanic corrosion.

When cathodic protection is required, joints shall be bridged to ensure continuous flow of current.

### Corrosion protection

All fittings, such as risers, ells, tees, and reducers, should be of similar metals. If dissimilar metals are used, the fittings shall be protected against corrosion. For example, separate dissimilar metals with a rubber or plastic insulator.

Interior protective coatings shall be provided when the pH of the water is less than, or greater than, the values shown in the following table:

Material	Water pH
Aluminized steel	O5-90
Galvanized steel	O6-100
Aluminum alloy	O4-100

Hot dipped asphalt, asbestos bonded bituminous, or polymeric coated galvanized, or aluminized steel pipe shall be provided if the soil resistivity is less than 3,000 ohm-cm. Aluminized steel pipe shall not be used when the soil resistivity is less than 3,000 ohm-cm.

Galvanized or aluminized steel pipe shall be used when the soil resistivity is greater than 4,000 ohm-cm, or aluminum alloy pipe may be used when the soil resistivity is greater than 500 ohm-cm.

Aluminum alloy pipe shall not be used when the soil resistivity is less than 500 ohm-cm or soil pH is less than 4 or greater than 9.

Cathodic protection. The total current required, the kind and number of anodes needed, and the expected life of the protection may be determined by the procedures contained in Practice Standard 430-F and Design Note 12.

If resistors are used to reduce anode current output to increase service life, the number of anodes required shall be based on the regular output of the anode rather than on the maximum output, Im.

Preliminary soil-resistivity measurements to determine coating requirements and the approximate amount of cathodic protection needed, may be made before the trench is excavated. For this purpose, field resistivity measurements shall be made, and samples for laboratory analysis shall be taken at least every 400 feet along the proposed pipeline and at points where there is a visible change in soil characteristics.

If a reading differs markedly from a preceding one, additional measurements shall be taken to locate the point of change resistivity determinations shall be made at two or more depths in the soil profile at each sampling station; the lowest depth shall be the strata in which the pipe will be laid. The lowest value of soil resistivity found at each sampling station shall be used as the design value for that station

After the pipe trench is excavated, a detailed soil resistivity survey shall be made as a basis for final design of the coating and the required cathodic protection. At this time, resistivity measurements shall be made in each exposed soil horizon at intervals not exceeding 200 feet. The lowest value of soil resistivity found at each sampling station shall be used as the design value for that station. If design values for adjacent stations differ significantly, additional intermediate measurements shall be made.

### **Anodes**

Anodes shall be at or below the bottom elevation of the pipeline if horizontally placed. Vertically placed anodes shall have a minimum distance of 3 feet between the ground surface and the top of the anode. Anodes shall not be placed in fill areas, magnesium anodes must be placed a minimum distance of 10 feet from the pipeline.

The lead wire from the anode, or the header wire for multiple anode installations, shall be attached to the pipeline by cadwelding, termowelding, or other similar processes. The area of damaged pipe coating and the

weld shall then be covered with a coating equal in quality to that of the specified original pipe coating.

### **Abrasion protection**

An interior asphalt coating and invert-paving shall be used where abrasion will be a problem.

### **Materials**

All materials shall meet or exceed the minimum requirements as set forth in 430II Materials Specification.

## **CONSIDERATIONS**

### **Water Quantity**

1. Effects on the components of the water budget, especially infiltration and evaporation.
2. Effects on downstream flows or aquifers that would affect other water uses or users.
3. Potential use for irrigation water management.
4. Effects of installing a pipeline on vegetation that may have been located next to the original conveyance.

### **Water Quality**

1. Effects of installing the pipeline (replacing other types of conveyances) on channel erosion or the movement of sediment and soluble and sediment-attached substances carried by water.
2. Effects on the movement of dissolved substances into the soil and on percolation below the root zone or to ground water recharge.
3. Effects of controlled water delivery on the temperatures of water resources that could cause undesirable effects on aquatic and wildlife communities.
4. Effects on wetlands or water-related wildlife habitats.
5. Effects on the visual quality of water resources.

**Endangered Species Considerations**

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

**PLANS AND SPECIFICATIONS**

Plans and specifications for corrugated metal irrigation pipelines shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

**OPERATION AND MAINTENANCE**

An operation and maintenance plan must be prepared by the Designer for use by the owner or other responsible for operating this practice. The plan should provide specific instructions for operating and maintaining the system to insure that it functions properly. It should also provide for periodic inspections and prompt repair or replacement of damage components.